



The problem of "fogging" in the living environment cannot be conclusively solved, until we learn which factors ultimately contribute to its origin:

- **Occupant habits** (ventilation, heating, use of candles, etc.)
- **Building condition**, and
- **Ingredient properties of products used**

As long as the cause-and-effect processes involved are equivocal, any remedial action can only be preventive in nature.

This includes, but is not limited to:


- Use of low-contaminant materials,
- Elimination of construction faults, and
- Proper heating and ventilation.

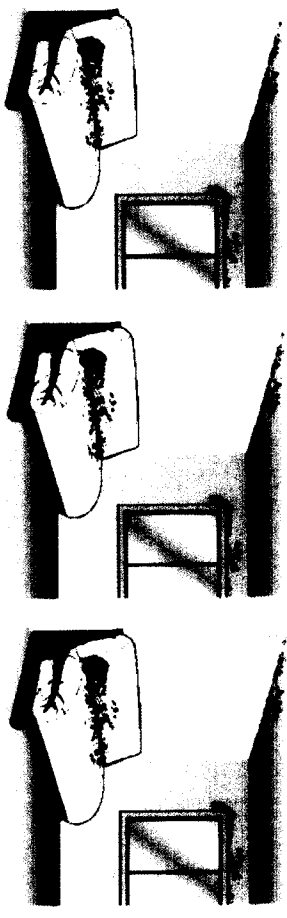
Initial steps as to material use, in order to reduce the level of indoor air polluting substances promoting this phenomenon, have already been taken: Miscellaneous paint manufacturers have started to offer "solvent- and plasticizer-free" products. Such practice could also be expanded to other materials intended for indoor use, and prone to emitting above problematic substances.

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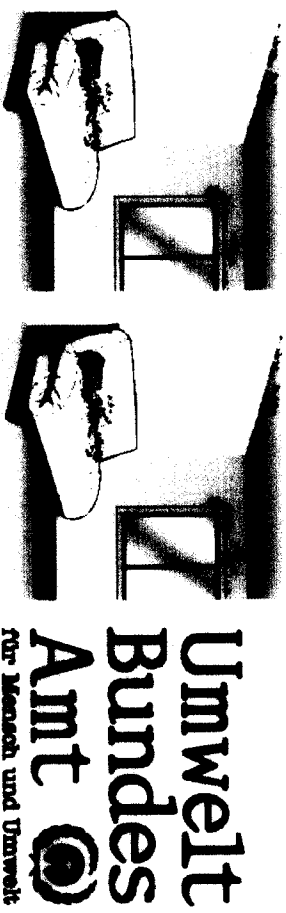
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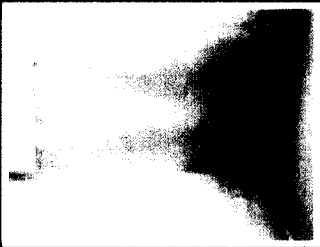
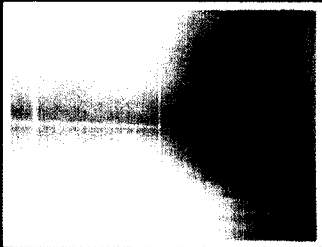
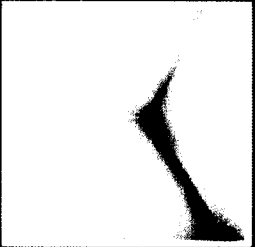
Attack of the Black Magic Dust - The "Fogging" Phenomenon

Causes - Effects - Remedy



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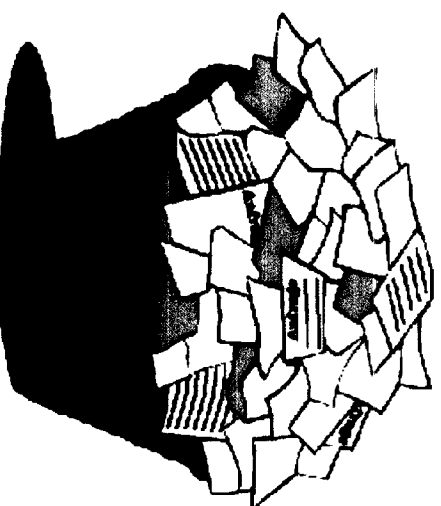
In the mid-nineties, the Federal Environmental Agency received first reports of sudden black dust deposits in living accommodations. Interior walls, ceilings, and furnishings were covered with a soot-like film – sometimes within days, in most cases within a few weeks. Seldom did this affect just one but rather several rooms of a given apartment. The damages ranged from isolated specks to major soiling similar to the remnants of a smoldering fire.

Initially, effort was directed towards potential indoor and outdoor sources of soot deposits. Chimneys and heating plants were inspected with no results. Influence factors from outside the living area were ruled out as well.

Neither could any other causes be detected at the time. The matter seemed highly mysterious. The only conspicuous detail was the fact that the deposits occurred almost exclusively during the heating period.

By early 2003, the Federal Environmental Agency had received reports of nearly one thousand cases of sudden black dust deposits in living accommodations – often also described as the phenomenon of "**black magic dust**" or the "**fogging effect**". The cases spread across all federal states.

The number of unreported cases, however, is most likely to be high due to ongoing uncertainty among those affected about how to deal with the problem and where to turn for support. In some cases, the problem is simply "tolerated", and no steps are taken to determine or eliminate the causes.





In the late nineties, the Federal Environmental Agency conducted two questionnaire surveys to establish equivalences and differences of sudden black dust deposits in living accommodations. By late 2001, a total of 287 cases had been evaluated; the basic results are as follows:

- A majority of the surveyed individuals described the deposits as "oily-grimy" and "blackish-gray". Occurrence was linked almost exclusively to the heating period.
- The deposits generally turned up in all rooms,

but often the living room was affected the most.

- Principally, any surface in the living area could have been contaminated. Nevertheless, the black dust settled primarily on radiators, drapes and curtains, window frames, plastic surfaces, electrical appliances, and the inside of external walls.

The accommodations were generally equipped with modern heating systems; coal stoves, fireplaces, and kerosene heaters were not an issue. Most rooms had wall-to-wall carpeting and woodchip wallpaper. A majority of the contaminated apartments had been renovated (68 percent) or newly built (24 percent) before the phenomenon occurred. In 67 percent of the households internal paintwork or varnishing had been done. In most instances, environmentally friendly paints and varnishes had been used. Nearly half of the investigated cases had the floors replaced, mostly by new wall-to-wall carpeting. One third of the living units had been subject to construction efforts. This specifically constituted installation of modern heating plants, new windows, or insulations inside or outside the house.

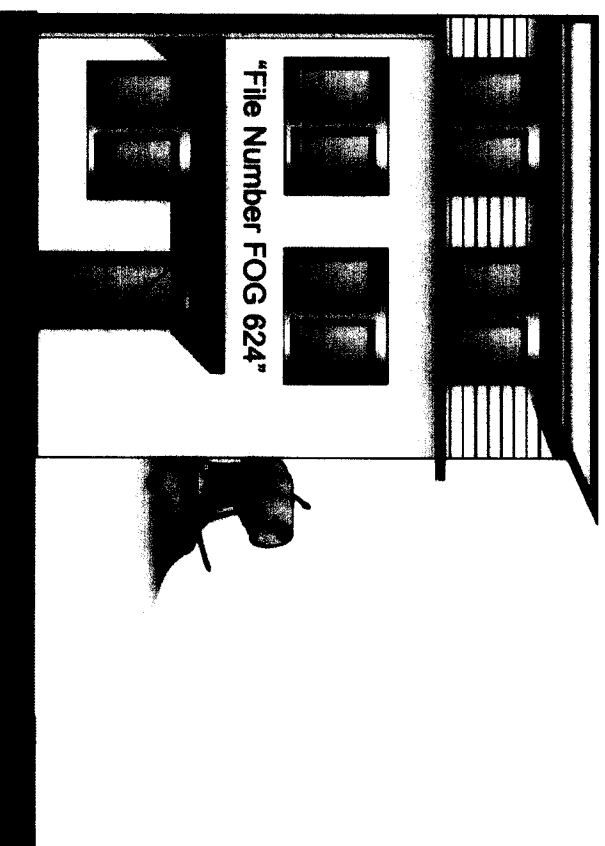


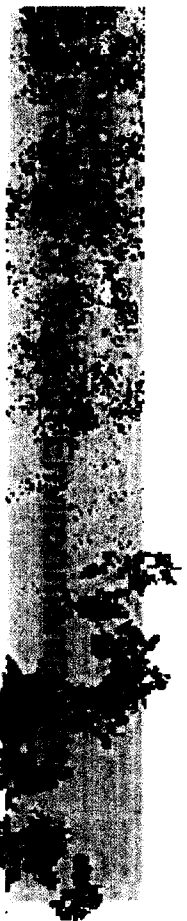
More than half of the surveyed households burned candles from time to time. The number of candles varied from a few candles – during Advent season – to daily candle use in the winter. The surveyed apartments more or less included an equal proportion of smokers' and non-smokers' households. In 28 cases, oil lamps were used; three households had an open fireplace; one apartment was equipped with a coal stove.

Indoor air temperature and humidity measurements were not conspicuous compared to those of non-contaminated apartments. The same applies to details regarding ventilation habits.

The apartments were ordinarily ventilated daily, some even several times a day, mainly sporadically – at the very least, by keeping windows in a tilt position.

As pollutant measurements inside contaminated apartments were only performed in isolated cases, using non-uniform procedures and techniques, the established readings were hardly commensurable with each other. The Federal Environmental Agency, in an extensive measuring program, used this as an opportunity for a more detailed examination of varied influential parameters within affected apartments in Berlin, Hamburg, and Braunschweig under standard living and housing conditions.

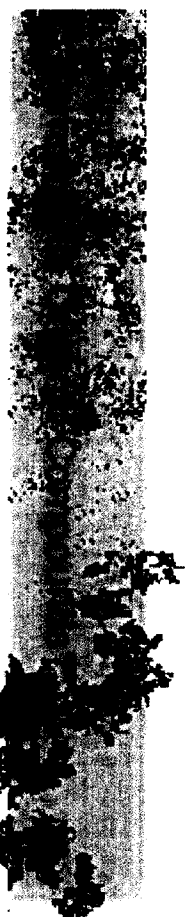
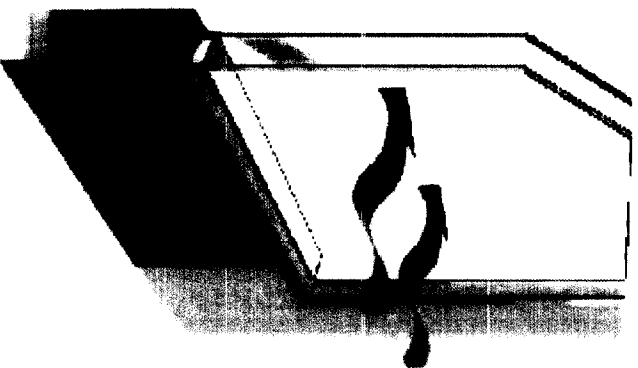




The "fogging" phenomenon did not become widespread until the nineties. Isolated accounts previously found in referenced literature were generally attributable to factors of a different nature – such as soot deposits, burnt carpet fibers, etc. As the problem principally presents itself in connection with recently performed construction and renovation activities, this detail must be a key factor.

In recent years, many manufacturers of construction, renovation, and furnishing products have put their efforts into an increased use of **semivolatile organic compounds** (SVOCs) as solvents or additives in lieu of **volatile organic compounds** (VOCs). These substances are mostly odorless, generally less health-risky, and do not have to be declared as solvents. To be precise, organic compounds having a boiling point above approximately 200° C are not considered "solvents". Therefore, products containing such compounds can be marketed as "solvent-free", and the term "solvent-free" is deemed a powerful advertising and sales message these days.

Moreover, due to environmental protection and energy conservation policies since the Thermal Insulation Ordinance of 1995 (replaced by the Energy Conservation Ordinance as of 2/1/2002), there are increased efforts to improve insulation and sealing techniques with regard to building shells in order to minimize heat loss. Unfortunately, there are indications that the restricted air exchange in sealed buildings, combined with increased indoor air emission of semivolatile organic compounds, may contribute to the "fogging effect".



Semivolatile organic compounds from products used during construction or renovation of apartments can invade indoor air quality. Especially, plasticizer compounds (phthalates), long-chain alkanes, alcohols, fatty acids, and fatty acid esters are instrumental factors.

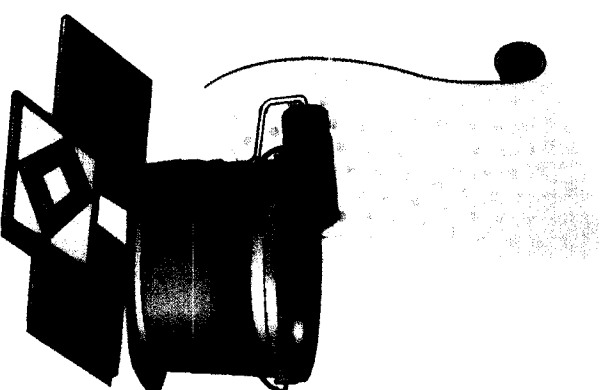
indoor air concentration levels of semivolatile organic compounds may rise significantly during the following transition and winter months due to heating and decreased ventilation and then – in combination with other factors – lead to the sudden black dust deposits.

- These semivolatile organic compounds are found, among other places, in
- Paints (even in so-called "solvent-free" paints) and varnishes,
 - Floor adhesives,
 - PVC floor coverings,
 - Vinyl wallpapers,
 - Plastic decorative tiles, and
 - Imitation wood panels.

Plastic surfaces such as furniture tops, for example, may contain plasticizers that potentially affect indoor air quality.

Physically speaking, semivolatile organic compounds have a lower emission rate than the previously used volatile organic compounds. On the other hand, they are often active for a longer period of time – in isolated cases even up to two years, or longer.

As a result, after renovation work completed in the summer, for example,

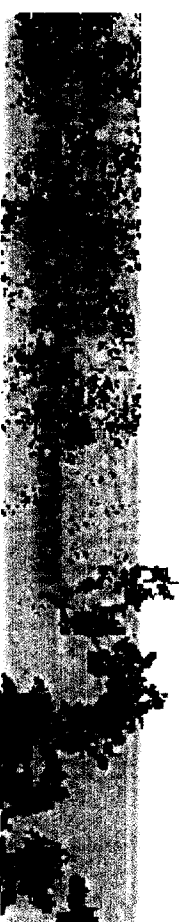
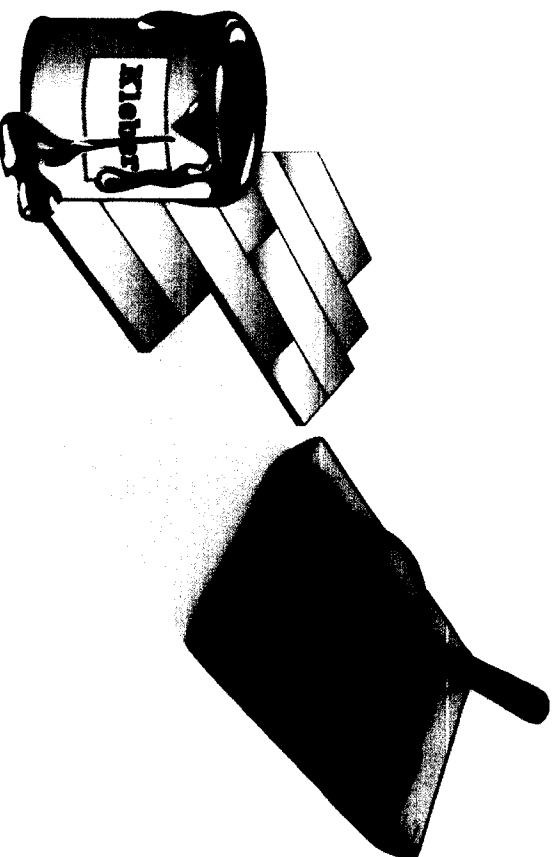


Evidently, under certain conditions, semivolatile organic compounds can combine with airborne particulate matter in the room to create larger particles and then form grimy deposits. Experts call this phenomenon the “fogging effect”. Black oily deposits, however, may also form on plasticized surfaces through airborne dust particles. This is the so-called “adhesive effect”.

The exact physical and chemical interactions, and the role semivolatile organic compounds play in the formation of black soot deposits in individual cases, remain ambiguous at present.

To be precise, numerous examples show that in newly erected or renovated apartment buildings, where identical construction products and materials were used, black deposits later occurred only in a few apartments. This leads to the conclusion that semivolatile organic compounds as such are not responsible for black soot deposits but become effective in combination with other trigger factors.

For information about influence factors on “black magic dust” in the living environment refer to our outline on Page 10.



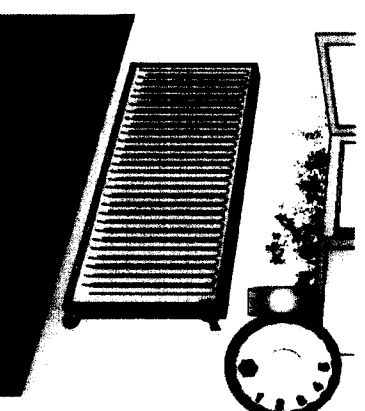
Unfortunately, the phenomenon of “black magic dust” is not only a sanitary problem but also often a legal one. Within the scope of tenancy actions, courts have to decide on a case-by-case basis, which party is to blame for the “fogging” phenomenon in living accommodations. Affected tenants complain about “rental property deficiency” and see a reason for rent rebate and compensation for damage. Proprietors try to rule out building influences and to prove it by obtaining expert opinions.

The phenomenon of “black magic dust” in living accommodations, as described, is an interaction process of a variety of influence factors. This makes it complicated for both the hygienist and the legal representative to determine unequivocal causes and – case by case – establish the responsible party.

The black deposits develop after renovation or initial occupancy of living accommodations in newly erected buildings. However, since black deposits in living spaces may also be attributed to other processes, such as combustion processes (“sooting”) or mold growth (black looking patches as well), such “classical” causes must be precluded in the inspection and assessment routine.

It is advisable to have the individual circumstances determined by qualified persons (industrial hygienists and expert agencies familiar with the “fogging” problem). Otherwise, the situation is open to misinterpretation.

As soon as the “black magic dust” phenomenon is unequivocally verified as indeed that, the search for root causes begins. The situation becomes often aggravated, when the expert is not called to the apartment until the problem has manifested itself for quite some time (e.g., during the previous heating period). By then, the deposits may already contain additional substances (secondary contamination) falsifying the analysis result. Therefore, timely action of everybody involved is the key.



Influence Factors for "Black Magic Dust"

(Important: Not all factors must be present at the same time.)

- **Renovation Effects:** Atmospheric deposition of semivolatile organic compounds leading to "fogging" and/or "adhesive effect".
- **Constructional Circumstances:** Thermal bridging; "cold" wall surfaces; adverse airflow influences; thorough sealing of building shell, and thus decreased natural air exchange.
- **Home Furnishings:** Plasticized materials, such as PVC-containing decorative tiles, plasticized furniture, etc.
- **Lifestyle Habits:** Atmospheric deposition of semivolatile organic compounds through oil-burning lamps and/or sooty candles in combination with irregular heating, poor ventilation (significant in sealed buildings), and/or increased airborne dust concentrations.
- **Indoor Air Quality and Weather Influences:** Insufficient humidity; increased electrostatic attraction.

Evaluation is far more accurate, if the expert is allowed to view the apartment immediately after the deposits have formed.

Some influence factors can be found in the building itself. Primarily responsible are constructional faults such as thermal bridges. Cold exterior walls are preferred targets for only deposits. Sometimes, the structural defect may then be instrumental in the manifestation of the deposits or the increased conspicuousness thereof.

Notwithstanding such circumstances, constructional faults do not necessarily contribute to the formation of the black deposits. In most cases, it takes an expert opinion to determine whether constructional faults are present and whether they were a contributive factor to the deposits.

Occupant habits must be considered as well. This includes, for instance, the use of oil lamps or sooty candles. Although not directly responsible (a sooty candle, for example, may leave a smutty stain on the ceiling but does not give rise to major discoloration in the overall apartment),

oil lamps or candles, in combination with additional factors, can accelerate, or intensify the formation of black soot deposits.

In a similar way, this also applies to heating and ventilation habits. Poor ventilation or improper heating alone is not the root cause of black deposits. However, turning down radiator thermostats all the way during instances of occupant absence and subsequently turning them back up during occupant presence (not the customary day/night adjustment of the central boiler) may promote the problem.

The substances infiltrating the living environment, and thus contributing to the formation of black deposits, usually stem from a variety of products. Different persons carry these products into the rooms (occupants, building operators, workmen). Principally, these individuals cannot be accused of culpable conduct, because they are oblivious to the products potentially contributing to the formation of black soot deposits.


From the manufacturing end, only a few suppliers have labeled their products so far, indicating problematic substances such as plasticizers, for example. Since not every plasticized product is likely to promote "fogging", most manufacturers see no need to identify the contents of their products as to concentration levels, for instance.

Nevertheless, there are also positive models: for some time now, several renowned wall paint manufacturers have offered paints that are clearly labeled "**solvent- and plasticizer-free**".

Likewise, the German eco-label, known as the "Blue Angel", is an important consumer hint for targeted product selection.




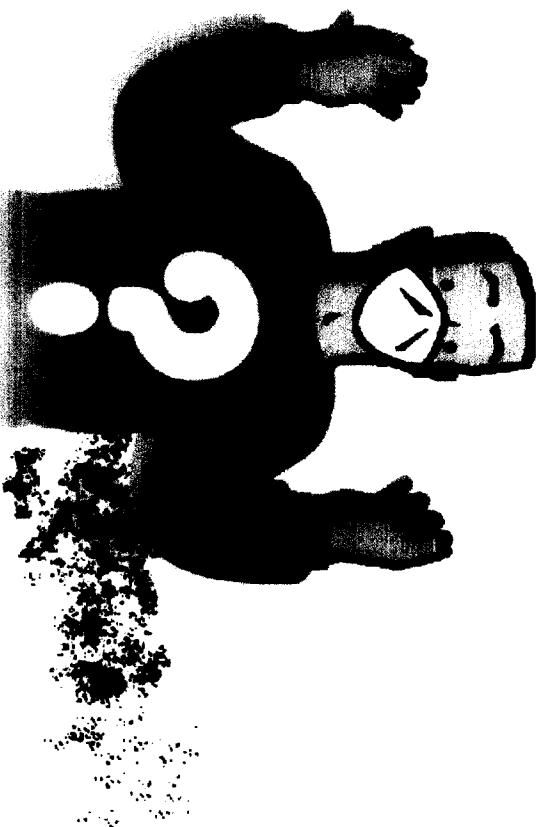
Especially in cases of previous problems with black soot deposits in the living environment, it is advisable to use only low-contaminant products for renewed renovation projects. Although that alone provides no protection against a recurrence of the black deposits (due to their complex formation process), experience has shown that the problem can usually be averted through targeted selection of renovation products and thorough ventilation over several weeks once the renovation work is completed.



Based upon current knowledge, black dust deposits present no immediate health risk. The concentrations of problematic substances, namely semivolatile organic compounds and plasticizers, in affected apartments are only nominally higher compared to non-affected apartments. According to present knowledge, the concentrations remain significantly below the threshold of a potential acute health hazard.

Still as a precaution, not to mention a solution to the "aesthetic" problem of an unsightly apartment, it is advisable to determine the root causes and get rid of the deposits.

In the event of increased concentrations of polycyclic aromatic hydrocarbons ("PAH") or soot (both a result of combustion processes), the deposits may present a health hazard, after all.

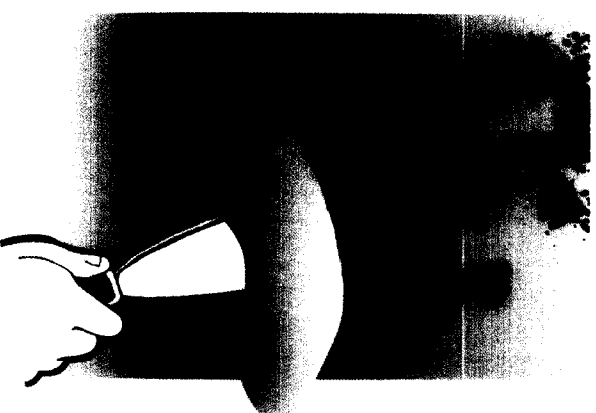


Before launching any cleaning and renewed renovation attempts in order to "remove" the deposits, the causes for the contamination ought to be investigated. It is not altogether necessary to eliminate all influence factors at the same time. Usually, it suffices to "remedy" just one or two. A step in the right direction, for example, could be the selection of solvent- and plasticizer-free wall paint during renewed renovation. Sometimes, modifying one's heating habits can be helpful. Eliminating constructional faults (thermal bridges) may keep deposits from selectively building up in such places. Finally, using candles and oil lamps in moderation is likely to ease the problem as well.

A removal of the deposits will often require intensive wet cleaning with detergents, cleansing agents, and similar soil removers. Simply painting over the oily deposits does not help in most cases. Cleaning activities may take such a toll on affected wallpaper, for example, that it needs to be completely removed. In some cases, removal of floor coverings, or major construction efforts (cutting down on thermal bridges) will be necessary.

Any such large-scale activities, however, should not be considered until "simple" renovation steps (using solvent- and plasticizer-free paints, proper ventilation after renovation, avoiding sooty candles, etc.) have failed to be successful.

In some cases, aside from the site inspection by competent experts, and the survey evaluation, chemical analyses of the affected accommodations are considered in order to get a clear picture.



Such analyses, however, are only useful, if the site visit has confirmed the suspected "fogging" phenomenon and the deposits have not been ignored for too long.

Analysis is also helpful, when there is ambiguity whether the deposits are black magic dust or soot residues from combustion processes (or both).

Procedure for Data Acquisition and Evaluation of the "Fogging" Phenomenon

1. **Site Inspection**
 - Visual check (appearance and type of deposits, deposit locations, accumulation volume)
 - Finger test (grimy?)
 - Building condition (outside & inside)
 - Structural condition of affected and, if necessary, adjoining apartments
 - Potential sources inside the apartment (furnaces, oil lamps, candles, etc.)
 - Potential soot sources from outside the apartment
2. **Background Data Collection**
 - Questionnaire survey
 - Additional background information (origin of problem – how and when, type of renovation, etc.)
 - Product information (for renovation products)
3. **Measurements**
 - Deposit analysis (wipe samples: SVOC, PAH, soot, if applicable)
 - Indoor air analysis (airborne particulate matter, grain size distribution, "fogging" measurement, PAH measurement)
 - Outdoor air measurement (airborne particles)
 - Microbiological measurements (only in suspected cases of mold)
 - Indoor temperature and humidity measurement
4. **Statement/Expert Opinion**
 - Evaluation of questionnaires and analyses results
 - Structural conditions
 - Occupant habits
 - Legally valid ("courtproof") statement
 - Recommendations/minimizing measures



Occupants affected by Black magic dust deposits first ought to contact the local environmental and health authorities. Many official agencies are aware of this problem – essentially through information efforts by the Federal Environmental Agency – and give advice on how to proceed. If they cannot provide assistance themselves,

they will generally be able to supply addresses of nearby environmental analysis labs that are equipped to perform indoor air measurements as well as "fogging" measurements and evaluations in particular. Experts are available from local Chambers of Commerce and Industry. Local consumers' agencies provide useful information on request. In addition, of course, the Federal Environmental Agency will be available for further information.

